

Denali Commission Award 1547 Kivalina RPSU CDR
Submitted by Alaska Village Electric Cooperative, Inc. (AVEC)
Final Closeout Summary Report July, 2020

This Closeout Summary Report is filed with the federal grantor agency the Denali Commission (“Denali” or “DC”) by the grantee partner Alaska Village Electric Cooperative, Inc. (AVEC). The federal grant award covered by this report and this project is 01547-00 (or “1547”), as subsequently amended. AVEC was the grantee of DC funding and managed and administered this conceptual design project.

This project is being closed because its objectives are completed satisfactorily, and the funding has expired. This report represents the project status as of March 31, 2020. Federal funds in the amount of \$189,591 are available for deobligation from award 1547.

Background – AVEC is a rural electric cooperative serving 58 rural Alaskan communities, all of which (with one exception) are for the most part accessible only seasonally by ship, and year-round only by aircraft. Consumers in these rural Alaska communities pay some of the highest electric power rates in the U.S. The electric power AVEC produces is primarily generated from diesel fuel, plus some contribution from renewable resources (primarily wind). AVEC’s diesel fuel is delivered by barge to its member communities during the shipping season and stored in bulk fuel tank farms for use year-round.

Kivalina, Alaska (population 442) is an AVEC member community located at the tip of an 8-mile-long peninsular spit of land located between the Chukchi Sea and Kivalina River Lagoon, 80 miles NW of Kotzebue (the nearest community with extensive state government services) and approximately 623 miles NW of Anchorage. Kivalina falls within the arctic climate zone, characterized by seasonal temperature extremes; winters are long and harsh, and summers are short but warm. The Chukchi Sea ice-free and open to boat traffic from Mid-June to early November. The official-census population grew from 117 in 1950, to 374 in 2010. The community incorporated in 1969 under state law as a second class city. It is a traditional Inupiaq village with a largely subsistence lifestyle. There are no major docking facilities; ship-borne freight is brought in by barge and offloaded onto a local beach landing zone during periods of calm seas. A state-owned lighted gravel airstrip serves scheduled and chartered flights from Kotzebue.

Activities – The scope for this project centered on publication of a Conceptual Design Report (CDR) to address necessary upgrades to AVEC’s power generation facilities (diesel-fired power plant); additional attention was paid to related energy facilities including the bulk fuel tank farm and pipelines that supply the power plant’s diesel fuel, and to other envisioned community infrastructure upgrades (most importantly the community school – the plant’s largest power customer). Compilation of the CDR required gathering and analyzing data, generating alternative solutions, selecting and justifying a preferred alternative, and creating a conceptual-level design and construction cost estimate for the preferred alternative. AVEC engaged consulting engineers CRW Engineering Group LLC (CRW) to accomplish this scope; CRW published the final CDR in October 2019. In addition to AVEC, primary organizations consulted included the Northwest Arctic Borough School District (NWABSD) and the State of Alaska Department of Transportation and Public Facilities (ADOT).

AVEC’s current power plant includes four diesel-fired generators totaling 1.18 MW capacity. Its buildings and equipment, for the most part, are not up to current code and are at or near the end of their useful lives; the same is true of the plant’s bulk fuel tank farm. On average the current power plant generates

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approximately 12.73 kWh per gallon of diesel consumed, or about 7% less than AVEC's generation fleet as a whole achieves (13.69 kWh/gallon, based on 2019 full-year data).

AVEC has long maintained prioritized rankings of its RPSU and BFU facilities, with the goal of first upgrading those with the highest environmental risk exposure; and/or those presenting the greatest opportunity for increases in fuel efficiency (defined as kilowatt-hours produced per gallon of fuel) - such as through consolidation and interconnection of communities, or through replacement of older, less efficient generators and control systems, or through incorporation of renewable energy sources, etc. Replacement and retirement of the old Kivalina power plant with a new, modern, efficient plant would accomplish several of these goals, most notably: increased operating efficiency; lower operating and maintenance costs; inclusion of control equipment in a new power plant's switchgear that would facilitate integration of power from potential future renewable energy sources; and increased, concentrated opportunity for valuable, useful heat recovery from the power plant's diesel engines.

Kivalina has experienced severe erosion during major coastal storms over the past several decades; as a result, residents have actively pursued funding for community relocation. In 2008 the U.S. Army Corps of Engineers completed an emergency erosion control and bank stabilization project; its stated purpose was to "... provide 15 years of interim erosion protection during which planning and relocation of the community can proceed". NWABSD is currently designing a new all-grades school, for an elevated site approximately 8 miles inland; the future new school is also envisioned to serve as an emergency evacuation shelter for the entire community. Accessing the new school site requires construction of a new road, including a causeway and bridge to span Kivalina Lagoon to the mainland; ADOT awarded a construction contract for this project, and construction commenced in early 2019.

The subject CDR identified two alternative sites for a new Kivalina power plant. Alternative 1 specified installing a new modularized power plant at the same site as the existing AVEC power plant, in the current community town site. Alternative 2 was prompted by the erosion issues and resultant school and possible community relocations discussed above, and specified installing a new modularized power plant along the planned evacuation road, approximately one mile east of present-day Kivalina and 1,000 feet inland. After careful evaluation of the strengths and weaknesses of each alternative, Alternative 1 was identified and justified as the preferable alternative; see the detailed discussions contained in the CDR for further information.

The basic design of the modularized power plant was essentially the same under both alternatives, to consist of a single steel module with field-installed roof system, partitioned into two generation bays featuring easy access for eventual overhaul and replacement, plus a day tank room and a control room. The CDR envisions the generation bays would house three 360kW diesel-fired gensets (1.08 MW total). Other recommendations included attaching oversized exhaust components to one of the gensets, to facilitate its replacement with a larger (500 kW) genset in the future, if needed.

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Funding and Costs – All funding for DC 1547 was provided by Denali Commission and totaled \$250,000; this funding exceeded total actual costs of \$60,409 (\$56,460 direct costs plus \$3,949 indirect costs) by \$189,591; all of which is federal funds available for de-obligation on award and project 1547.

Conclusions – Kivalina’s power plant, and the bulk fuel tank farm serving it, should be upgraded to modern, efficient, code-compliant facilities.

Bibliography:

CRW Engineering Group LLC: *Kivalina, Alaska, Rural Power System Upgrades, Conceptual Design Report*. Prepared for Alaska Village Electric Cooperative, Inc.; October 2019.